TRAFFIC ENGINEERING

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

THE COVER depicts the two extremes in highway location. In the early days engineers equipped with a compass rode wagons and counted wheel revolutions. Today, origin and destination surveys based on home interviews by attractive young ladies give the preliminary data necessary to determine location. (Painted for the Institute by Miss Mary Leach of Arlington, Va.)

May We Offer . . .

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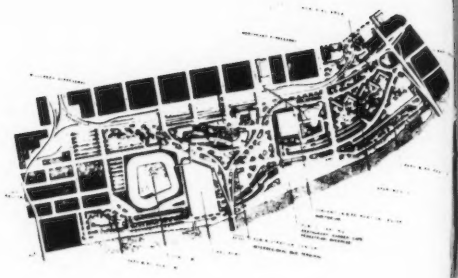

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Geometrics of Highway Design in New Jersey

by CHARLES M. NOBLE,
State Highway Engineer

THE greatest weakness in past highway construction has been the inability to keep pace with the development of the motor vehicle. This development progressed so swiftly that it was practically impossible for highway design to conform, even reasonably, with the operating potentialities of the vehicle, and to provide for the weaknesses and shortcomings of the driver. The result is that many existing highways are but a further development of the carriage roads of yesterday, and as such are poorly equipped to handle the demands of present motor traffic. This has been the cause of enormous monetary loss in physical investment due to obsolescence, untold suffering and sorrow, and a staggering economic waste due to accidents and traffic delays. To properly cope with increasing traffic volumes and greater speed, modern highway design must take these factors into consideration.

Oppose Changes

In the middle 1930's this factor was becoming apparent to a few farsighted highway engineers who advocated the adoption of a design philosophy embodying functional characteristics capable of safely and expeditiously carrying the increasing traffic volumes. "Dualization" of highways, control of access, separation of grades, adequate right-of-way widths, elimination of pedestrian traffic, and other important features formed the basis of this new design philosophy. As in most cases where any radical departure from accepted practice is advocated, this new conception of motor roads met with opposition from many quarters. Objections were raised on the basis of additional right-of-way and construction costs, violation of the right of access, and information on justifiable traffic volumes.

Despite this opposition, however, there was a determination on the part of forward-looking engineers to rectify design thinking which forced the driver and the motor vehicle to conform to the highway rather than design highways with characteristics capable of meeting the demands of the automobile. This thinking resulted in the development of the freeway and parkway principle which embodies all features of functional highway design. The intervening years witnessed the construction of the Pennsylvania turnpike, the Merritt parkway, the Chicago Outer drive, and the fine network of parkways in and around New York City. More recently many other fine examples of parkways and freeways have been constructed in other sections of the country.

Free From Hazards

On properly designed freeways and parkways, traffic can flow swiftly and safely without the throttling effect of cross traffic, left turns, stop lights, and pedestrian interference. Furthermore, these highways are free from

Appreciation is expressed to Mr. Carman Davis of the department staff in the preparation of this article.

hazards and traffic frictions occasioned by roadside development which destroy transportation efficiency and increase accidents. Median strips separating opposite direction traffic greatly minimize the danger of head-on collisions and lessen driving fatigue. The provision of scientifically designed access and egress facilities located at reasonable intervals and equipped with acceleration and deceleration lanes allows vehicles to enter and leave the main highway with maximum safety and minimum traffic disturbance.

In New Jersey, where 80 per cent of the population is urban, and where geographic considerations generate almost unparalleled traffic volumes, immediate construction of highways of this type is an economic necessity. The acuteness of conditions confronting New Jersey is realized when its geographic location and resulting traffic volumes are analyzed. Although but forty-fifth in size, New Jersey ranks sixth as an industrial state, second only to Rhode Island in density of population, and has nearly 59 per cent of its population concentrated within 11 per cent of its total area. It is located between New York and Pennsylvania, the states with the first and second largest populations in the United States, and between New York City and Philadelphia, the first and second largest seaports in the country. Over New Jersey highways rolls this vast inter-city commercial, industrial and pleasure traffic, as well as that originating in the South and West with destinations in New York or New England.

Metropolitan Area

Coupled with these factors, and contributing even more to traffic congestion, is the fact that New Jersey, although but 17 per cent the size of New York, contains 30 per cent of the population and nearly 45 per cent of the motor vehicle registration of that state. In addition, traffic is generated by 125 miles of seashore resorts which annually attract millions of visitors from all sections of the country, but particularly from the great metropolitan areas of North Jersey, New York City and Philadelphia.

This is the situation challenging the designers of the New Jersey State Highway Department as they look to the future and consider measures to cope with ever increasing traffic volume, strangling congestion, and the accident problem. It is recognized that the "at grade" type of highway now prevalent, where crossings with streets and highways occur at frequent intervals, cannot carry large volumes of traffic expeditiously except where cross traffic is of very moderate proportions. This is well illustrated by statistics covering a 21-mile stretch of U. S. 1 in New Jersey, where average traveling time, under peak traffic conditions, is 2 hours, or at a rate of slightly over 10 m.p.h., despite the fact that a minimum of two lanes in each direction, much of it "dualized", is available. Express (Freeway and Parkway) type highways of the limited access design offer the only permanent solution to such conditions. Awareness of this fact has led New Jersey, under the leadership of State Highway Commissioner Spencer Miller, Jr., and cooperating citizens' groups, to sponsor freeway and parkway legislation which provides for the immediate construction of such highways. As defined under the New Jersey law, the terms are not synonymous although both are "controlled access" highways and abutting property owners in each instance have no rights of light, air or access to these highways. Freeways are designated for use by all types of motor vehicles while parkways are limited to passenger vehicles.

Designate Routes

To date the New Jersey Legislature has designated the following freeways and parkways:

1. Route 100 Freeway, extending from the George Washington Bridge in Bergen County, southward through Hudson, Essex, Union and Middlesex counties, to a connection with US 1 near New Brunswick.

2. Route 4 Parkway, extending from Clifton, in Passaic County, southward through Essex, Union and Middlesex Counties to Cape May at the extreme southern tip of New Jersey, with a branch from Woodbridge to Trenton.

3. Route S-100 extending from US 1 at Newark to Route 100 at Elizabeth.

4. Route 300 Freeway from the proposed bridge connecting New Castle, Delaware and Deepwater, New Jersey (now under design by the Delaware State Highway Department), to a connection with Route 100 near the Raritan River.

5. Palisades Interstate Parkway extending along the Hudson River from the New York State line to the George Washington Bridge.

6. Trenton Freeway.

7. North-South Freeway in Camden.

8. East-West Freeway in Camden.

9. Bayonne Freeway.

As an example of the application of the freeway and parkway principle and of design thinking in New Jersey, a brief description is given here of both Route 100 freeway and Route 4 parkway, each of which is now under construction. Geometric design requirements for the freeway and the parkway are not identical because they are called upon to perform different functions. Route 100 is a "dual-dual" highway consisting of four 24-foot roadways, two in each direction. The outer roadways will handle the "local" traffic while the inner roadways will serve the through traffic. Each of these roadways is composed of two 12-foot traffic lanes. Except in densely built-up and industrial areas the through traffic roads will be separated by a 40-foot median strip which is made up of a 30-foot depressed island flanked by a 5-foot shoulder on each side. Between the express roadways and the "local" roadways is a space of 25 feet which consists of a 10-foot depressed island, a 10-foot shoulder adjacent to the express lanes and a 5-foot shoulder adjoining the "local" roads. On the outside of the outer (local) roadways is a 10-foot shoulder. The center island will be landscaped and planted to minimize headlight glare. All drainage, except for the outer half of the "local" roads will be toward the depressed islands. This design minimizes pavement icing due to intermittent freezing and thawing after snow has been pushed

SANDBAGGING INTERSECTION

Using sandbags to channelize vehicles, the Virginia state highway department is attempting to gain design information for revising the intersection of US 50 and SH 7, Fairfax county. Sandbags permit the easy revision of an intersection design and enable traffic engineers to select the best of a series of designs most suited to the convenience and safety of the motoring public.

This type of design practice has been used extensively by traffic engineers. Galveston, Texas, practiced this system using old tires painted white in place of sandbags.

from the roadways to the islands and keeps the slush and water clear of the travelled lanes.

Curves

A minimum radius of 3000 feet will be used except in heavily built-up areas where 1600-foot minimum radius curves may be permitted. Minimum values will be permitted only in case of absolute necessity. Generally, radii of curves will range between 6000 feet and 20,000 feet. Curves will be superelevated and, whenever radii of 3500 feet or sharper are used, curves will be equipped with transition spirals. Adequate distances between reversed and same direction curves will be maintained.

In establishing the rates of superelevation, the limitations on speed imposed by available rear-end collision sight distance, due to vertical and horizontal curvature, was given careful study. In the interest of safe operation, care was taken not to set up such high rates of superelevation on the flat curves that drivers would be encouraged to travel faster than the limitations imposed by sight distance. In addition, slow moving vehicles, such as large trucking units, may be induced to edge in because of the forces of gravity and crowd the adjacent lane if high rates of superelevation are utilized on easy curvature.

Transition Lanes

Acceleration lanes will be provided at turnouts of sufficient length to enable vehicles to increase speed to the rate at which it is safe to merge with through traffic. It is believed that the relative speeds of merging traffic should not vary by more than 10 m.p.h. These acceleration lanes are 1200 feet in length and every effort has been made in the design to induce traffic to merge at a flat angle. The angle of convergence of the acceleration lane with the main roadway is about 1 degree.

The length of a deceleration lane is a function of the design speed, as it is desirable that a deceleration lane be of sufficient length so that a vehicle may slow down by engine compression alone to make the turnout. On Route 100 the initial length of decelerating lanes is 800 feet. This is measured from the beginning of the lane to the nose of the turnout. The beginning of the turnout is about 185 feet from the nose, leaving approximately 615 feet. The design speed of the turnout is 55 m.p.h. To decelerate in gear from 70 m.p.h. to 55 m.p.h. requires 600 feet. Although an initial length of 800 feet for deceleration lanes will be provided, bridge clearances, etc., will be so arranged that these lanes can be extended to a length of 1200 feet if deemed desirable in the future.

Sight Distances

Grades on Route 100 will be held to a maximum of 3 per cent, a desirable maximum of 2 per cent and a minimum of 0.5 per cent. Maximum rear end collision sight distances from height of eye to a 4-inch object will be 600 feet, thus making available a car to car vision of approximately 1200 feet.

Slopes

Where feasible, flat side slopes will be used on fills up to 10 feet high in all but the heavily congested urban areas for the dual purpose of eliminating guard rail and to stabilize the slopes against erosion. Gentle slopes will also materially facilitate mowing and landscaping operations.

Shoulders

Route 100 will be provided with stable shoulders, level with the pavement, in order that vehicles may leave the pavement at cruising speed and park completely off the roadway. These shoulders will serve two functions. (1) They will provide "elbow room" for vehicles to use in case of

emergency, and (2) they will serve as a space for stopped vehicles to park clear of the travelled way. Present day statistics indicate that car breakdowns occur at a rate of one breakdown per 7500 vehicle miles. Thus if a road carries 15,000 vehicles a day, two breakdowns per day for each mile of road may be anticipated and many of these cars can be expected to stop for a considerable period of time. If shoulders are not provided, such broken down cars must occupy a travelled lane, thus presenting a collision hazard and causing serious traffic congestion on busy highways.

Uniformity

All the elements of design should be consistent and uniform. Too often standards of alignment, grade and sight distance vary greatly from section to section of highway. Monotony must be avoided, however, in order to lessen drowsiness and inattention. Landscape planting can be utilized to advantage in obtaining the desired variety. However, such planting should be designed so as to maintain the maximum sight distance that is afforded in the physical geometric design of the roadway.

Route 4 Parkway

The design standards for the Route 4 Parkway differ slightly from those used on Route 100 Freeway. Instead of employing four roadways of two 12-foot lanes each, the Parkway design incorporates two roads of two 12-foot lanes. Provision is made so these roads may later be widened to three 12-foot lanes when future traffic volumes make such a change advisable. The roadways of the Parkway will be separated initially by a 60-foot median strip island of the depressed type. This strip width includes a 3-foot stable shoulder on the inside of each roadway. When the two additional lanes are installed at a later date, the island width will be reduced by 24 feet. On the outside of each roadway will be a stable 10-foot shoulder.

Where the deceleration lanes on the Route 100 Freeway are being constructed 800 feet initially, with provision made for eventual lengthening to 1200 feet, those on the Parkway will be 600 feet in length. The acceleration lanes on the Parkway will be 1000 feet long in contrast to the 1200-foot length employed on the Freeway. These shorter distances are made possible by the elimination of trucks from the Parkway.

Full consideration is being given to the aesthetic features of both Freeways and Parkways. Bridge architecture, signs, light standards, etc., while fully meeting their functional requirements, will conform as much as possible with natural surroundings. Landscape treatment will make full use of native growth and form a natural and pleasing transition between the highway and the adjacent countryside.

This, briefly, is the design practice to be incorporated in New Jersey's highways of the Parkway and Freeway type. Throughout the United States a change in the basic conception of highway design is becoming increasingly evident. Already a few farsighted communities are enjoying the advantages afforded by highways which embody functional characteristics necessary for safe travel. Many more are planning and promoting these highways as the best solution to the problems incurred by increasing traffic congestion, and as a guarantee against obsolescence caused by marginal ribbon growth. The evidence today points to the fact that highway designers are at last becoming fully awakened to the fact that highways must be made to conform to the vehicle and its operator. This marks a great forward step in the field of automotive transportation.

NATIONAL CONFERENCE ON SAFETY DISBANDS

The National Conference on Street and Highway Safety, known since its inception in 1924, principally as the coordinating agency responsible for keeping up to date the Uniform Vehicle Code and the Manual on Uniform Traffic Control Devices, was officially disbanded at a meeting of its Executive Committee on May 7, 1947. For more than 10 years its activities had been practically only those carried out through its Committee on Uniform Traffic Laws and Ordinances and through its participation in the work of the Joint Committee on Uniform Traffic Control Devices.

Since it was believed desirable to bring the activities for the future within the framework of the Action Program of the President's Highway Safety Conference, the Executive Committee of the National Conference on Street and Highway Safety proposed that its organization be discontinued and that its successor be the National Committee on Uniform Traffic Laws and Ordinances. This action was taken and the following officers of the new organization were elected: Chairman, George Wellington, Interstate Commerce Commission; Secretary (full time), Charles W. Stark, recently retired from the Chamber of Commerce of the United States; Legislative Draftsman, J. Allan Davis, Automobile Club of Southern California; Chairman of Executive Committee, Colonel A. B. Barber, Chamber of Commerce of the United States; Treasurer, A. W. Koehler, National Association of Motor Bus Operators. A vice-chairman is yet to be appointed.

The Governing Rules of the new National Committee set forth its purposes as follows:

"The purpose of the National Committee on Uniform Traffic Laws and Ordinances . . . . shall be to carry out the President's Highway Safety Conference recommendation that this committee review and revise periodically the Uniform Vehicle Code and Model Traffic Ordinance; to prepare explanatory materials for use in promotion and adoption of those standards; to cooperate in similar reviews and revisions of the Manual on Uniform Traffic Control Devices; to render service to officials and the general public relating to those standards on legislation and control devices, their interpretation and suggested changes."

PARKING METER INSTALLATIONS IN CITIES

The Public Works Engineers' News Letter reports that during 1946, 448 cities installed parking meters, bringing the total number of cities operating meters up to 924. Revenue from meters is sizeable, particularly in cities where meters are extensively used, as indicated by San Diego which collected $279,000 from 2,422 meters; Denver which collected $269,000 from 3,029 meters; and Dallas which collected $190,000 from 1,500 meters. The table below, compiled by Vehicular Parking Ltd., shows the number of cities operating meters at the close of 1946. Average annual revenue per meter approximates $100.

Population Class	Total Number of Cities in Class	Number of Cities Having Meters	Per Cent
More than 500,000	14	4	29
250,000 to 500,000	23	15	65
100,000 to 250,000	55	38	69
50,000 to 100,000	107	60	56
25,000 to 50,000	213	120	56
10,000 to 25,000	665	288	43
5,000 to 10,000	965	222	23
Less than 5,000	14,710	177	1

Expressways of Hartford

by FRANCIS E. TWISS, *Research Assistant*
Yale Bureau of Highway Traffic

THE EXPRESSWAYS of Hartford owe their existence today to the advance planning of state and city officials with the assistance of the unfortunate floods of 1936 and 1938 in the Connecticut River. In 1936 approximately 25% of the area of the city was inundated by water which rose to a height of about seven feet above the highest previous recorded flood.

It was this flood that crystalized plans for the formation of the Hartford Flood Commission to study the protection of the city from future excessive high water in the Connecticut River. The 1938 hurricane with its attendant flood, although not as serious, gave added impetus to the plans being formulated by the Department of Engineering of the City of Hartford acting as the engineers for this Commission. In conjunction with these plans there was brought into existence the first system for handling the increasing traffic problem through the construction of expressways.

Second Bridge

As the preliminary plans for the Hartford Flood Commission progressed, it became evident that the provision of a second bridge across the Connecticut River at Hartford was necessary so that cross river communication during abnormal floods would not be affected. The traffic congestion on the old bridge as far back as 1929 was of such magnitude that the legislature of that year recognized the need of a new bridge and passed an act creating the first bridge commission. The work of this commission was unfruitful due to the general economic conditions during the early '30s. Therefore, plans for the bridge were revived, and along with planning for flood protection, provision was made to incorporate a major expressway system with a portion of the flood works.

In 1939 an act was passed authorizing the Governor to appoint a new bridge commission. The commission was formed and directed to study the feasibility of constructing a toll bridge at Hartford and, if it found the project self-liquidating, to issue bonds of the State of Connecticut for construction of such a bridge. A firm of consulting engineers was engaged to make a comprehensive economic and traffic study of the situation, especially in relation to the free bridge, and to report to the commission the amount of capital outlay that could be financed through a reasonable system of tolls. Their report showed that a sufficient capital outlay was available so that the project was feasible with a ten cent basic toll charge based on the expected volume of traffic that would use the bridge.

Approaches to Bridge

The new Charter Oak Bridge was subsequently designed and constructed under the supervision of the Connecticut State Highway Department. It was completed and opened to traffic in September 1942. The bridge commission was cognizant of their responsibility to provide adequate ap-

proaches so that traffic could get to the bridge in the location chosen. The approaches, therefore, as financed by the bond issue, actually begin at the traffic circle on the east edge of Bushnell Park in Hartford and end in East Hartford at the grade separation over Main Street.

The two aerial photographs show the extent of expressway construction to date within urban Hartford. Figure 1 shows the general location of these

Figure 1

expressways in relation to the major street pattern in the central section of the city. The Whitehead highway extends from the circle at "A" to the Connecticut River at "B". The Conland Highway is that section between "B" and the approaches of the Charter Oak Bridge at "C". The grade separation over Main Street in East Hartford, mentioned before, is at "D".

Figure 2 is an airplane view of the bridge looking southeast with its immediate Hartford approaches in the foreground. In the upper left-hand corner the grade separation at Main Street in East Hartford, mentioned above, may be seen. Note the typical funnel shaped design of the toll collecting facility. The bridge was designed to carry 5000 vehicles per hour on two, twelve-foot lanes in each direction separated by a four-foot medial divider. It provides approximately 90 foot clearance for river traffic in the channel at its center. The approaches in the foreground on the west end of the bridge were laid out as a very special grade separation and provides for all movements of intersecting highways, but does not provide access to adjoining city streets. From this general location it is necessary for local traffic to go approxi-

Figure 2

mately one-half mile to the nearest access ramp.

Dike Raised

While this bridge and its approaches were being constructed, design and construction was progressing on the flood protection for Hartford under the joint supervision of the Flood Commission and the Army Engineers. This included the raising of the existing dike around the south meadows, the construction of combination earth dike and concrete wall along the east side of the center of the city, construction of earth dike around the north meadows and construction of the Park River Conduit. As a portion of the original design, between the new bridge and a point several thousand feet north of the existing bridge, the new dike provides for a riverfront highway which will be part of the north-south expressway for

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Hartford so that traffic can proceed into and out of the city without interfering with local circulation on the existing street system.

It was originally planned by the Army Engineers to provide concrete walls on each side of the Park River up to high ground approximately the height of the dike. However, the preliminary planning for the new bridge showed that this location would be ideal for its Hartford approach, therefore the decision was made to enclose the Park River in a conduit and use the top of it for the Whitehead highway (Park River Express Highway). This highway is shown in Figure 3. It begins at the traffic circle in the foreground, located on the southeast corner of Bushnell Park and ends at the sharp curve where it connects with the riverfront highway. That section of the riverfront highway between this point and the Charter Oak Bridge has been officially named the Conland Highway and was constructed as part of the flood protection in this area.

Circle Is Key

It will be noted that complete access to local streets is provided by the circle. This circle was warped in design to accommodate the heaviest flows of traffic. It is about 200 feet long with a 75-foot radius on the north end and a 100-foot radius on the south end. The roadway is 30 feet wide in general, but varies depending on conditions at each point around the circle.

The first bridge along the highway in Figure 3 is Main Street where an existing arch structure was retained and the roadway alignment adjusted to obtain the maximum clearances. The next three bridges are new steel and concrete structures and provide for local traffic movement with no interference with the vehicles bound for the bridge. Ramps were provided as shown at Commerce and Prospect Streets and take care of traffic bound for and bound from the Charter Oak Bridge. If this highway is extended to the west it is planned to construct more ramps as needed.

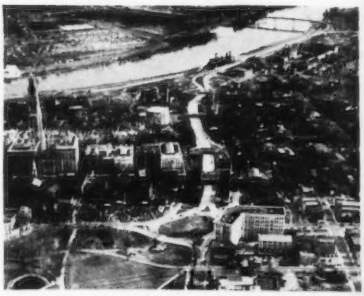

Figure 3

Design Data

The alinement of the Whitehead highway was predetermined to a great extent by the location of the conduit and the former river's edge. Therefore, the curves were not designed in accordance with any standard design speed as such. All ramps were held to a maximum five per cent grade. The roadway cross-section consists of two, twelve-foot lanes in each direction separated by a four-foot medial island. Eight-foot shoulders of concrete are provided wherever the width of right of way permitted.

The photographs and sketch, however, do not show the total extent of expressway construction and plans in the Hartford area. Considerable more expressways or limited access roadway has been constructed, is being constructed and planned in the suburban Hartford. Figure 4 shows the proposed express highways in relation to the existing state highways. Each of these highways are in the planning stage and show the approximate route only and will be changed as further investigation and planning is accomplished. That section which we have been discussing is a continuation of US 5 running from the east side of

(*See* HARTFORD *on page 454*)

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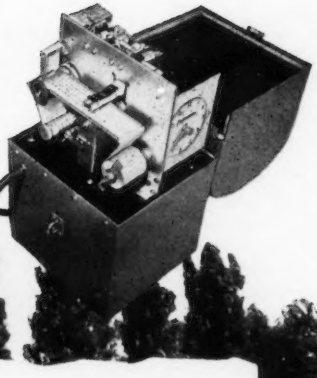
ARE YOU PLANNING AHEAD?



Many state, highway and county engineers are not only "planning ahead" for the construction of new highways and streets, but have already, through the aid of Streeter-Amet Traficounters, made extensive surveys . . . and are ready to put into operation a complete construction program, as soon as facilities and materials are available.

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Toll and Free Roads

by JERRY MAGNER

ONE of the most challenging articles of recent months on the timely and important subject of financing for highway improvements is one appearing in the SATURDAY EVENING POST called, "No Relief for the Motorist", by Henry F. Pringle. It comes at a time when states everywhere are anxious to begin construction of needed highways and other road facilities, but are facing the growing realization that adequate improvements will not be possible from moneys available in general tax funds.

The article begins with the unquestioned statement that the roads of the nation are wholly inadequate to meet the present heavy demands, and that in type and design nearly all are obsolete. It continues with the disturbing truth that traffic volumes can be expected to increase at unprecedented rates to intensify the already unmanageable problem. Unless immediate action is taken, the only end result can be a "long spell of unhappy motoring".

Funds Limited

The author points out further that the $500,000,000 authorized by Congress for federal aid during the first three post-war years, even when matched by equivalent state funds, can do little more than scratch the surface and is a pitiful approach to a problem of tremendous proportions. If we are to catch up with our long-deferred highway improvement program a great deal more must be done. For a painless and available solution, he turns to the device of tolls, or other direct assessments on the persons who use the roads.

Several of our more successful toll projects are then listed to support his contention, notably the Pennsylvania Turnpike and Connecticut's Merritt Parkway. Here, undoubtedly, are two of the finest stretches of road in the United States. Each has stepped up driving speeds considerably; at the same time the accident danger has been cut as much as 30 per cent. And they have been financed largely by the motorists who, if they object to paying for what they get, have been "remarkably silent about it". The author concludes that building others on a similar toll basis would "eliminate the terrible drain on general tax funds. It woud end the existing stagnation in highway building".

Use Limited

It is to be remembered, however, that like many other financing panaceas which have come to the surface in the past, toll roads are easily worshipped beyond their just dessert. They have advantages, but at the same time they have their limitations and are capable of considerable mis-use and abuse. Some of these have been pointed out by Mr. Pringle. He writes: "Free highways appeal to political expediency. Technical difficulties, such as toll collections and competing free roads, are often hard to solve. In some situations toll roads are not feasible".

With deference to the author's judgment, it seems appropriate here to bring out others, and to elaborate

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Mr. Magner is obtaining a master's degree in Political Science at Stanford. At present he is at Yale's Traffic Bureau working on a thesis entitled "Municipal Organization for Street Traffic Control."

on those he has mentioned so that both sides of this very controversial subject may be viewed in clear perspective.

From a purely financial standpoint, revenue bonds are not a drain on the general funds, if revenue rates have been properly figured. It must be borne clearly in mind, however, that the cost of services paid for these utilities is just as much a charge against constituent wealth as any other type of bond supported by general taxation. To this extent revenue producing bonds do, in the final analysis, draw on state resources by affecting the capacity for carrying debt and taxation loads.

Benefits Limited

Again from the theory of finance, the highway-user tax collected from motorists as a special charge for highway services purports to assess the beneficiary in accordance with the benefit he receives. But while the motorist is to stand all the costs on toll highways, he is not the only beneficiary. These facilities greatly enhance the public welfare and serve a great number of private interests and activities. Within the full meaning of the special benefit theory, an equitable tax base and a fair allocation of costs will not be provided.

The Public Roads Administration objects strenuously on purely practical considerations. It has long been their view that toll roads are at best only partial facilities, capable of serving only a part of the traffic requiring service in the direction in which they extend and in the areas they traverse. Paralleling free roads must always be maintained to serve the remainder, and probably the large remainder, of the traffic. Moreover, the design standards of the free road must be held materially lower than those of the toll road, else the latter may be robbed of nearly all of its essential support.

The P.R.A. would also question the argument that under present market conditions the toll expedient offers the only hope for immediate highway improvements. At a time when public highway authorities find it difficult to obtain at reasonable cost the materials, equipment, labor, engineers and contractual services for the correction of serious deficiencies in the public road system, the wisdom of introducing new and competing demands for these scarcities is difficult to determine.

NEW ORLEANS BOND ISSUE APPROVED

Backed by a taxpayer vote favoring a $23,500,000 bond issue to finance the work, officials of New Orleans, La., are pushing negotiations to get a 3-phase civic improvement project started.

The overall plan—which would provide a new union terminal, grade-crossing elimination, a new civic center and extensive street paving—will involve the expenditure of more than $40,000,000.

The new terminal and grade elimination portion will call for spending about $29,000,000 of which the city will pay less than half, and the railroads involved the balance, except for $2,200,000 to be contributed by the state highway department. (Engr. News Record.)

New Jersey Maps Plans for Safety

by HERBERT A. KEEGAN, *Associate Editor*

COMPREHENSIVE PROGRAMS of coordinated action to strengthen and improve safety methods, so that in every community the services necessary to accident reduction will be available, were mapped at the New Jersey Governors Highway Conference at Trenton, in May.

The way was led by state safety officials and members of non-official groups interested in the problem of making highways safer. Participants in discussions included those charged with enforcement, education and engineering of counties and municipalities, intent on bringing home to their localities on an organized basis the safety campaign which, on the state level, has been saving lives and reducing injuries and property damage.

The program consisted of a general sessions, the Public Support Session, Lloyd M. Felmly, Editor, Newark Evening News, presiding.

Two Sessions

The afternoon was divided into two sessions, the Public Support Session, Wayne D. McMurray, President Asbury Park Press, presiding and the Official Action Session, Col. Charles H. Schoeffel, Supt. of State Police, presiding.

Motor Vehicle Commissioner Magee, co-chairman of the conference with Lloyd M. Felmly, led a forum on the major causes of motor vehicle accidents. He took each of the five top causes—(1) following too closely, (2) violating right of way, (3) speeding, (4) driving on the wrong side of the road and (5) improper turning—for separate treatment, posing questions for the consideration of the group as to possible means of bettering present methods of combating them.

Mr. Magee stated that the state service that is available through the Highway Safety Co-Ordinating Committee can be looked upon as a center for collection and dissemination of information and the drawing together of practical experience and scientific understanding, crystalizing these into standards for use of all interested agencies.

Highway Commissioner Miller declared that the engineer has an opportunity to perform service in the safety field that is second to none. He said the trouble has been one of attempting to adapt 1947 automobiles to 1921 roads. We must begin to design highways that will be safeways, he declared.

"The ultimate answer to the problem is parkways and freeways. They are designed to meet the problems of the future. We are now attempting to design highways adapted to the automobile rather than adapting the automobile to the highways."

Schools' Part

In telling of the schools' part in fostering safety throughout the state, Education Commissioner Bosshart cited gains already made, declaring that the schools are attempting to bring to pupils not only information on safety methods but also to build character into their awareness of the problem. Out of their teaching, he said, should emerge a sense of responsibility not only to their own welfare

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but to the welfare of others on the highway.

The three E's plus traffic courts were discussed at the afternoon session of the officials group. State Police Superintendent Schoeffel, chairman, declared that state, county and municipal officials must share in the responsibility for an effective, continuing safety program.

Pointing out that some estimates indicate that traffic volumes in 1960 will be about twice that of 1941, Essex County Engineer Colwell said that engineering forces are faced with a problem of considerable magnitude that would seem to make the problem of accident reduction look rather hopeless. Every level of government from the local municipality up should right now be planning for future highway facilities. Failure to provide for the future can only result in congestion which will produce accidents and resultant economic loss.

Recommend Television

At the afternoon session of the Public Support Section, Jack R. Poppele, Jr., Vice-President and Chief Engineer of radio station WDR, visualized programs within a year or two that will give the public lessons in safety by television.

Recalling the early days of radio, Poppele looked into the future for television.

Poppele visualized an airplane shooting pictures of highway traffic conditions and transmitting them to the homes of those who might be preparing for a Sunday drive or a week-end trip.

Leonard Dreyfuss, Pres., N. J. Advertising Club, urged a state strategy committee on safety. He said advertising, newspaper and radio men know the best appeals to public psychology and that this knowledge should be used to sell safety. He proposed safety messages on gasoline pumps and in highway restaurants and inclosures with department store and utility company bills.

The proposal for safe driving schools came from Philip S. Carter of the Plainfield Junior Chamber of Commerce and S. Herbert Turkington, Director of Safety Education in the Leonia High School.

Carter also proposed periodic re-examination of drivers through scientific testing devices and a law which would authorize judges to sentence traffic law violators to attend safe driving courses.

Turkington said that driving instruction courses in all high schools under minimum standards set by the state Board of Education would have a marked effect in reducing accidents, because it would instill the safety lesson in the 18 to 21 year-olds, who, he said, have the worst record for recklessness.

RUST PREVENTION

Wartime experience of the Army and Navy in protecting equipment against rust and corrosion is being used by state highway departments, according to the Public Works magazine. Seven states—Alabama, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, and Missouri—are using a priming paint containing zinc yellow pigment for protection against rust on both new and existing steel highway signs. Zinc yellow is a pigment that was used in paints on Navy ships, Army jeeps, trucks, tanks and planes, for an undercoat next to bare steel and aluminum. Primers formulated with the pigment dry rapidly and provide a hard, adherent surface for the finish coat.

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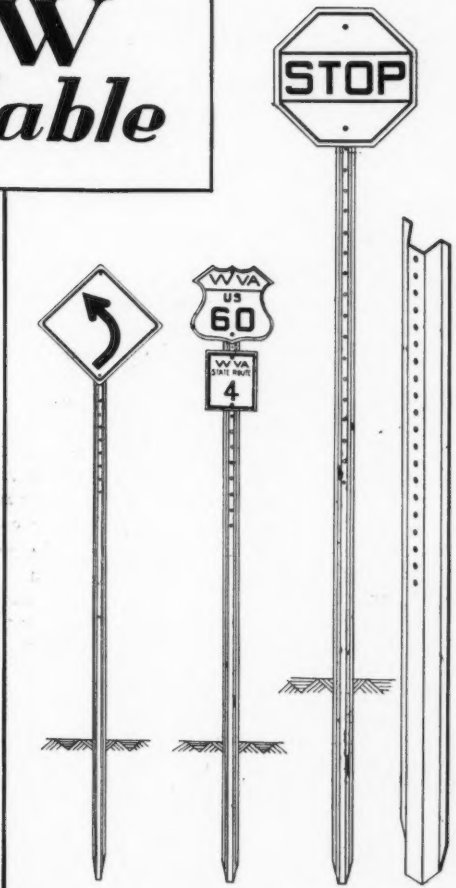

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Microwaves Measure Speeds

by PAUL L. GREEN, *Assoc. Member, I. T. E.*

THE magic of microwaves has brought to the traffic engineer a timely tool to assist him in studying the characteristics of vehicle flow on our streets and highways. Previous methods of determining vehicle speeds have usually involved tubing, light beams, mirrors, and the like. Now comes an application of the radar principle which permits accurate measurement of vehicle speeds by a portable instrument, easily operated by one man from a point adjacent to the travelled surface of the roadway.

The Electro-Matic speed meter operates on the fundamental theory that a radio wave when reflected from a moving target will cause a shift in the reflected wavelength proportional to the speed of movement of the object. The Meter utilizes an oscillator circuit employing an ultra high frequency oscillating tube and a fixed frequency oscillator cavity. Approximately .1 watts is generated at 2455 megacycles coupled directly to a multiple dipole antenna array which radiates microwave energy toward the moving vehicle. A portion of this radiated energy strikes the surface of the vehicle and is reflected back to a similar dipole antenna connected to a receiver unit. The direct signal from the transmitter and the reflected signal from the moving vehicle are mixed in the receiver and the output signal contains only the difference frequency. This difference frequency is directly proportional to the vehicle speed in miles per hour and is amplified and translated to a linear scale reading on a meter calibrated in miles per hour.

Operates on 6 Volts

An important feature of the meter is its ability to operate from a 6 volt automobile battery or from a 115 volt 50-120 cycle AC power supply. The current drain from a storage battery is about 8 amperes, the AC power rating being 50 watts.

To facilitate operation the speed meter is in three parts. The transmitter-receiver is 12 in. x 12 in. x 7 in. and is mounted close to the highway with its antenna face pointed toward oncoming traffic. This unit may be readily set up on a tripod, box, parked automobile, or the like.

The indicator-amplifier which contains the meter is 9 in. x 9 in. x 6 in. This unit may be placed inside or outside the automobile, at the convenience of the operator.

The power unit is 10 in. x 5 in. x 4 in. and is equipped with a pair of leads and clips for connection to the battery of the observer's car, and with a socket and cord for connection to 115 volt AC power supply.

Light Weight

A carrying case, 26 in. x 16 in. x 9 in., is furnished to contain the three units of the meter and their connecting cables. The total weight of the instruments and their carrying case is approximately 45 pounds.

When the equipment is set up it is ready for operation after a period of two or three minutes for warming the tubes. The operating zone extends about 150 feet in front of the antenna and the effective zone width at this distance is approximately 30 feet. The speed range of the instrument is 0 to 100 miles per hour with scale division of 2 miles per hour, linear. Accuracy is within 2 miles per hour throughout the entire range. The meter detects

the speed of vehicles moving in either direction through its field.

Inasmuch as the instrument radiates energy it is necessary that a license be obtained from the Federal Communications Commission, a second class experimental license being assignable. This license is obtained by submitting the proper application forms to the commission. A single station license will cover the maximum stated number of speed meters to be operated by the highway or police department, for example, within its territory. Once a station license is obtained it is then possible for any authorized employee to operate the equipment, individual operator's license not being required. However, only the holder of a second class radio operator's license may adjust or service the equipment.

Permanent Record

An important feature of the electromatic Speed Meter is its ability to furnish on a tape a permanent record of the speed readings which are simultaneously indicated on the meter scale. This is accomplished by the utilization of a special type of Graphic Recorder which is plugged into a socket on the power unit and operates from an auxiliary circuit built into the meter. The graphic recorder as ordinarily supplied is spring wound, has a capacity of 100 feet of tape and usually is operated at a speed of 1½ in. of tape per minute.

A wide field of usefulness is indicated for the meter. It affords the traffic engineer a means of studying vehicle speeds in relation to zoning, curves, grades, intersection approaches, and the like. It is likewise evident that the meter will find important application in the hands of police authorities and in fact wherever studies of moving objects are required. The speed range of the instrument is by no means limited to 100 miles per hour.

REPORT ARIZONA ROAD PROBLEMS

by MARGARET WOOLVERTON
Associate Editor

Highlighted at the 1947 spring meeting of The American Society of Civil Engineers in Phoenix, Arizona, was a paper by E. V. Miller, Chief, Division of Plans, Arizona State Highway Department.

Sixty per cent of Arizona's primary federal aid system is inadequate by modern standards and needs, Mr. Miller reported. The reasons: (1) insufficient funds, (2) too few route location studies, (3) no definite master plan for reconstruction, and (4) reluctance on the part of the public to accept recommendations based upon technical analyses of highway needs. It is estimated, according to Mr. Miller, that $100 million will be required to bring Arizona's primary and secondary road system up to acceptable standards.

Mr. Miller pointed to US 66 as typical of Arizona highways. It traverses the northern part of the state from east to west and is about 384 miles in length. Of the entire length, only about 27 per cent is up to standard and the remainder requires modernization. It is estimated that it will take until 1957 to complete a modern two-lane highway along this route, but projected traffic volume figures show that by that time, or a year later, the need will be for four lanes. In anticipation of this, sufficient right of way for four lanes is being acquired for some sections at the present time.

Design speeds for US 66, said Mr. Miller, are from 70 to 100 miles per hour, depending upon the terrain. Maximum curvature is two degrees in open country, four degrees in rolling terrain, and six degrees in "precipitous" areas. (Arizona has so much of the latter type that it is called

"precipitous" rather than mountainous.) Superelevation is 0.125 ft/ft at low altitudes and 0.080 ft/ft at higher altitudes where icing conditions may be encountered.

Widths are based upon traffic volume, as follows:

Vehicles Per Day	Width in Feet
Under 50	26
50-300	28
300-1,000	34
1,000-3,000	40

The urban problem along US 66 is complicated by the fact that most cities were laid out in the early days by Santa Fe railroad engineers and the main street is usually narrow and parallel to the railroad, according to Mr. Miller. Since studies show that only a small percentage of traffic would use by-pass routes, the main streets must be widened or alternate one-way streets must be established. Preliminary studies made during the war indicated this need, but plans so conceived were met with so much local disfavor that the entire program was jeopardized. Today, however, said Mr. Miller, congestion has become so serious that two cities have asked the state for help.

Other projects of interest reported on by Mr. Miller include an origin-destination and speed-and-delay study of routes between Phoenix and Tucson, and an origin-destination study of the Phoenix Metropolitan area.

NIGHT ACCIDENTS ARE REPORTED MORE FATAL

The chances that a traffic accident will be fatal are 40 per cent greater after dark than in daylight, according to analysis of 261,304 accidents just completed by the Street and Traffic Safety Lighting Bureau's office of informational services.

The study, which emphasizes the need of adequate light for traffic safety, covers all accidents, both urban and rural, occurring in 14 states during a 12-month period.

The number of fatal accidents after dark averages 40.1 per cent greater than daylight despite 21 per cent average fewer total accidents. Only two states have a higher daylight fatality rate. The range in percentage of dark-hour fatalities is 45.1 per cent for Maine to 64 per cent for Massachusetts.

Of the 261,304 total accidents studied, 116,561, or 44.6 per cent, occurred in darkness. There were 30,429 fewer total accidents in darkness than in daylight. Fatal accidents totaled 8,389 of which 4,880, or 59.9 per cent, happened after dark.

The chances of an accident being fatal are one to 22 after dark, compared with one to 37 in daylight.

DON'T SAY "TRAFFIC DEATHS"

Don't use the term "traffic deaths." Say instead "traffic casualties" and include both deaths and injuries. So urges the National Committee for Traffic Safety, according to a vote taken at the annual meeting in Washington, D. C. This was deemed to be a valuable suggestion to all agencies engaged in public information activities.

NINETEEN ENGINEERS COMPLETE TRAFFIC ENGINEERING STUDIES AT YALE

Nineteen men have just completed a graduate course in traffic engineering at Yale University. The course required a full academic year of graduate study in such matters as the basic theory and practice of traffic regulation, design, planning and administration, dealing with problems of safety and expenditious movement in highway transportation.

"The training of these men and their return to active positions in public service is especially timely in view of the rising toll of traffic accidents and the waste of community resources through congestion", stated Mr. Theodore M. Matson, (Mem. ITE) Director, Bureau of Highway Traffic, in commenting on the work. "It is especially timely in view of the increasing congestion and the resultant irritation to the public in their daily use of streets and highways. Moreover, the accident toll has been increasing since the war", said Mr. Matson.

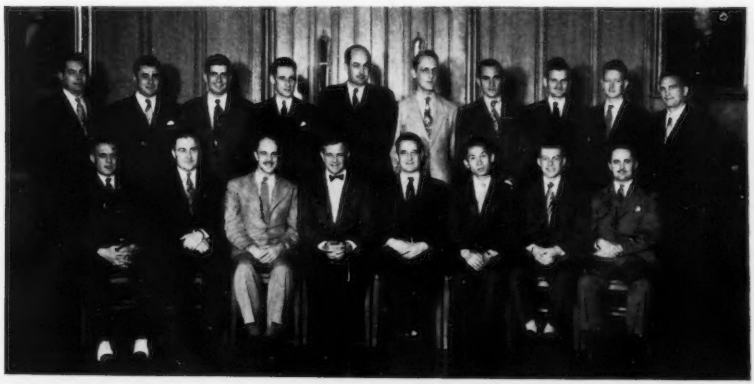
These men represent various branches of state highway departments and city agencies. They came from state highway traffic engineering departments, as well as design, planning, and maintenance divisions. The men from urban areas came from traffic engineering divisions and city planning commissions.

These men will go out to join 152 men already in the field who have completed the course of study of the Yale Bureau of Highway Traffic and its predecessor at Harvard. The great majority of these men, once having specialized in traffic work, are challenged more than ever with the need for such work and continue in active service.

The names and former positions of the men completing the course are:

Roger T. Chandler, Planning Division, Maryland National Park & Planning Com. Webb J. Crecink, Division of Highway Planning, Mississippi Highway Department. David F. Dabney, Location Division, New Mexico State Highway Dept. Earl H. Flynn, Division of Highway Control, Connecticut

(*See* YALE *on page 453*)



Front Row: Messrs. Webb J. Crecink, Earl H. Flynn, Robert E. Schmidt, John H. Hulse, Emrys E. Lewarch, E. C. M. Lee, S. T. Siegel, and H. Dean Fravel.
Back Row: Messrs. Roger T. Chandler, Murray Zides, Jerome D. Franklin, Herbert J. Klar, Arthur M. White, James R. Wichman, Richard I. Strickland, David F. Dabney, George A. Hill, and A. L. Hutchison. Absent from the picture was Capt. Edwin L. Mills.

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School Buses Standardized for Safety and Economy

by BELMONT FARLEY, *Director, Press and Radio Relations, National Education Association of the United States*

A chrome yellow bus slows to a full halt. On the rear in black letters are painted the words: SCHOOL BUS—STOP ON SIGNAL, automobiles following come to a standstill; for it is state law. The youthful occupants of the bus debark and scamper to a schoolhouse, or leave by twos or threes in a succession of bus stops if being transported to their homes after school. This action can take place anywhere in the United States—Montana, the plains of the west, or the crowded streets of metropolitan areas in the east.

In Wisconsin, however, drivers do not stop behind a chrome yellow bus, but behind a red, white and blue vehicle. In Pennsylvania, the color is orange, and it may have the variation of an aluminum painted roof if local school authorities wish. In Massachusetts the bus may be white or yellow. In some states SLOW is substituted for STOP in the rear of the house and in others only the words SCHOOL BUS appears.

Standardization Started in 1937

Making the school bus really standard is a job undertaken in recent years through the cooperation of state school transportation officials and the manufacturers of the bodies and chassis of school buses. There were forty-eight standards in as many states, and a few left over in the territories, when in 1937, the Federal General Education Board appropriated funds for a nation-wide study of school transportation. This was made under the direction of Dr. Frank W. Cyr, professor of education at Teachers College, Columbia University and disclosed so many types of school buses and so many ways of operation that the net result was confusion, inefficiency and high transportation costs.

Recognizing the need of greater uniformity in a business for which $66,000,000 was appropriated in 1939, the National Council of Chief State School Officers sponsored a conference in that year of representatives of state departments of education, engineers, body and chassis manufacturers to draw up minimum standards for the construction and equipment of school buses.

Standards Adopted, Revised

These standards have been widely adopted by the states, and substantial progress made in standardizing the safety and economy factors of school transportation. Important technical developments of the motor industry and seven years of experience, which included the unusual strains of war, pointed to a revision of the standards. Again a National School Bus Conference, administered by the Commission on Safety Education and financed by the Automotive Safety Foundation, assembled late in 1945 at Jackson's Mill, West Virginia, to consider further improvements in the design of school buses which would take chil-

dren more economically and more safely to school.

Exceptional cooperation of customer and manufacturer allowed those who make buses and those who buy them to canvass every detail of design from the front bumper to tail light for economy and safety factors. The ideal year for the conference was 1945 because assembly lines had been converted from wartime production, the number of irreplaceable school buses that had coughed through their last mile and been dragged off the highways had mounted month by month and transportation officials estimated that 50,000 new buses will be needed as soon as available. They will bear the stamp of the National School Bus Conference.

Flexibility Permitted

The new school bus will vary in a few particulars from state to state in answer to the demands of highway construction and climate. The curvaceous roads of the mountain states dictate a length and balance of body not necessary on the plains. The subzero winter temperatures of Michigan's northern peninsula require insulating and heating that would be superfluous in Florida. But the vehicle transporting children safely to school in Montana is soon to appear much like the one that performs the same class of service in South Carolina. The economy of standard manufacture is to become increasingly evident.

Standard color as a means of identification is held desirable by many school transportation officials so that motorists from any state would recognize a school bus in any other state, as far as he could see the vehicle. He would know that the bus might stop at any time to unload occupants who must be protected from other highway traffic as they cross the roadway.

Many Factors Considered

Many factors other than color contribute to the safety of pupils who ride school buses, and affect the cost of the buses to those who transport pupils. Shatter-proof glass has long been universal on motor vehicles carrying passengers, but the windows of a school bus are something special. Windows that can be fully opened provide temptation for protruding arms and even heads and shoulders. Windows that will not open fully can fatally imprison the occupants of a bus that takes fire in an accident. The School Bus Conference adopted as national standard a window that raises nine inches, no more, but of a type called the "split sash," which can be knocked out with a blow of a shoe or even of a school book, and an emergency door, is a "must".

The new school bus will *not* carry the warning STOP on its rear emergency door. A semaphore will display that warning only when the command is to be immediately obeyed by the motorist who observes it.

The economy of manufacturing a bus to a single design instead of a number of designs conforming to the varying specifications of a score or more states is obvious. Manufacturers and educators who created the standard design are more enthusiastic about the increased safety of the new buses than they are about the economies achieved.

Reprinted, in condensed form, from the magazine, BUS TRANSPORTATION, January, 1947

HIGHWAY STATISTICS

All of the 1945 highway statistics, distributed individually by the Public Roads Administration, have been assembled and bound into permanent form. Bound copies are for sale by the Superintendent of Documents, Washington, D. C., at 35 cents per copy.

Activities . . . .

YEARBOOK CHANGES

Phillip E. Taylor, 2109 27th Street, South Arlington, Virginia.

Robert E. Dunn, Asst. Traffic Engr., Dept. of Hwys., Transp. Bldg., Olympia, Washington.

F. Houston Wynn, Dept. of Public Works, Honolulu, Hawaii.

Walter H. Klapproth, Vice-President, 6625 Avalon Avenue, Dallas, Texas.

William H. Voltz, Dept. of Vehicles and Traffic, 307 6th Street, N.W., Washington 1, D. C.

Robert O. Swain, 2312 North Vernon, Arlington, Va.

SECTION NEWS

WASHINGTON SECTION

The Washington Section of the Institute of Traffic Engineers held its regular monthly meeting on May 21st, 1947 at the Fairfax Hotel, and 22 members and guests were present.

An annual report of meetings held throughout the year and a report of the financial status of the Section were presented by the Secretary-Treasurer.

Plans were discussed regarding the next meeting, which will be held on June 18th, the night before the opening of the President's Highway Conference. It is the hope of the membership of the Washington Section that a number of out-of-town ITE members will attend.

Mr. John Mitton gave a report of progress on the situation with regard to the proposed Washington Engineers Club and also a report on a recent Dinner for Congressmen. So far 725 applications for membership in the Engineers Club have been received.

Mr. Wallace Braun reported on the proposed District of Columbia Engineers License Law and recommended that the Washington Section of ITE approve the proposed bill. There was considerable discussion on the subject and finally a motion was made to the effect that the Section go on record as approving the bill, but that with this approval there be submitted suggestions for clarification. Of the 19 active members present, 17 voted for approval on this basis and 2 members did not vote.

An annual election of officers was held and the following persons were elected:

President, John Mitton.
Vice-President, Don W. Loutzenheiser.
Secretary-Treasurer, LeVerne Johnson.

H. F. LAW TO ADDRESS ANNUAL ITE MEETING

Harvey F. Law, administrator of Washington's National airport, has accepted an invitation to speak at the Eighteenth Annual Meeting of the Institute of Traffic Engineers at the Hotel Ft. Shelby, Detroit, October 1 through 4.

Mr. Law is considered one of the country's outstanding airport planners and administrators. His speech before the Washington chapter last spring was one of the highlights of the year's program.

In addition to his work at the National airport, Mr. Law is consultant to several cities and assisted the Port of New York Authority in its recent studies of the major airports in New York City and vicinity.

The ITE program committee has also received acceptance of an invitation extended to H. E. Hilts, deputy commissioner of the Public Roads Administration, Mr. Hilts will discuss the latest revisions in the manual on uniform traffic control devices.

Other highlights of the annual meeting include an extensive discussion of the parking problem. Two technical papers will feature this discussion. One is to be presented by Edmund R. Ricker who is doing special research of this type at Yale's Traffic Bureau. The other will be presented by Robert H. Burrage, of the Public Roads Administration. Papers on the parking problems are also slated to include viewpoints from the businessman and from planning officials.

ITE LECTURERS AT YALE

Members of the Institute who were guest lecturers at the Yale Bureau of Highway Traffic during the academic year 1946-47 are:

William E. Billings, Director, Traffic Safety Bureau, Liberty Mutual Insurance Co.; Nathan Cherniack, Economist, The Port of New York Authority; Roy W. Crum, Director, Highway Research Board; Edward H. Holmes, Chief, Division of Highway Transport Research, U. S. Public Roads Administration; G. Donald Kennedy, Vice-President, Automotive Safety Foundation; Merwyn A. Kraft, Director, Dept. of Personnel and Accident Prevention, American Transit Association; Franklin M. Kreml, Director, The Traffic Institute, Northwestern University; D. W. Loutzenheiser, Highway Engineer, U. S. Public Roads Administration; Burton W. Marsh, Director, Traffic Engineering & Safety Dept., American Automobile Association; D. Grant Mickle, Director, Traffic Engineering Division, Automobile Safety Foundation; John Paver, President and General Manager, National Outdoor Advertising Bureau; William Powell, Consulting Engineer; Kirk M. Reid, Illuminating Engineer, Engineering Division, General Electric Co.; Lawrence S. Tuttle, Assistant to Commissioner, U. S. Public Roads Administration; Leslie Williams, City Planning Engineer, American Transit Association.

I T E PERSONALS

D. JACKSON FAUSTMAN (Assoc. Mem.) is transportation engineer for the California Public Utilities Commission in San Francisco. Mr. Faustman was formerly associated with the Sherrill Instrument Company in Indiana.

CHARLES F. CASHELL (Assoc. Mem.) is recovering from the mumps. Mr. Cashell is deputy director of Technical Division II, Engineer Board, Ft. Belvoir, Va.

WILLIAM E. EGAN (Assoc. Mem.), city traffic engineer and secretary of the Hartford Traffic Commission, was recently admitted to the bar in Connecticut.

HARVEY D. BOOTH (Mem.), formerly with the National Safety Council and the Arkansas Highway Department, is traffic engineer in Hyattsville, Md.

JAMES S. BURCH (Mem.), engineer of statistics and planning for the North Carolina Highway and Public Works Commission, is chairman of the Highway Research Board's newly created committee "Influence of Shoulders on Traffic Operations." Other ITE members serving on the committee include **HARRY H. HARRISON, GLEN SMOOT, EARL W. OSTERHOUDT** and **DONALD BERRY.**

MARGARET WOOLVERTON (Assoc. Mem.) is conducting city traffic surveys in California.

M. V. GREER (Assoc. Mem.), traffic engineer for the Texas Highway Department, reports that he is busy organizing his office which was recreated about a year ago following a wartime suspension.

HENRY A. BARNES (Assoc. Mem.), traffic engineer for Flint, Michigan, has recently completed some consulting work in Arizona and had some interesting experiences appearing before the State Corporation Commission.

WALTER GOTTSCHALK (Applicant), formerly Traffic Engineering Assistant, Department of Public Safety, Flint, Michigan, has accepted a position as Supervisor of Traffic Planning associated with **EARL REEDER** (Mem.), in Miami, Florida.

ROBERT E. DUNN (Assoc. Mem.), formerly director of the Spokane Metropolitan Traffic Survey, has returned to his position as Assistant Traffic Engineer, Washington Department of Highways, Olympia.

WALTER KLAPPROTH (Mem.) has returned to Dallas, Texas, where he lives at 6625 Avalon Avenue. Mr. Klapproth has been living in South Gate, California, where he was president of Transit Bus Sales, Inc.

WILLIAM A. VOLTZ (Mem.), formerly a member of the staff of the Bureau of Traffic Planning, Pittsburgh, is now with the Department of Vehicles and Traffic, Washington, D. C.

BARTON CONDUCTING CHICAGO STUDY

George Barton (Mem. ITE) heads one of two firms engaged to conduct a two-year parking study in Chicago. Harry W. Lochner represents the other firm.

The study is sponsored by the Chicago Association of Commerce and the State Street Council which have appropriated $60,000, with the understanding that this is an action program and not a study project. Barton and Lochner are expected to assist in obtaining any necessary legislation and public support for the actual installation of parking facilities in the Loop area.

The action study was initiated by a cordon count of Loop traffic in which IBM cards pre-punched as to station, time of entry, and questions were used. The chief questions asked were:

Where do you live (distance from the Loop, etc.)?

What is chief purpose of this trip to Loop area?

Is the trip for a brief stop in the Loop, for a shopping trip of 15 minutes or longer, or does your route simply pass through the Loop?

Mr. Barton was formerly associated with the Chicago Motor Club. He served in World War II as a colonel in the Transportation Corps.

Personalities . . . .

This is the second in a series of articles about Institute Members

Philadelphia's traffic engineer is the Institute's vice-president who has been active in traffic work since 1930. Robert A. Mitchell has used his bachelor of architecture degree from Cornell University (1921) advantageously in planning the traffic facilities for one of the country's largest cities.

A veteran of World War I, Mr. Mitchell was born in Bloomfield, N. J., and attended public school in Norfolk, Va.

Starting as designing traffic draftsman in Philadelphia in 1930, Mr. Mitchell was promoted to traffic signal engineer in January, 1936 and to traffic engineer in May of the same year. The office, at the time of his appointment as traffic engineer was a division in the bureau of police, with only managerial responsibility over traffic control and accident problems and a staff of 25 people. In 1940, the bureau of traffic engineering, as it exists today, was created by city ordinance, with direct control over all phases of traffic and safety including the purchase, installation and maintenance of all regulatory equipment. The bureau was set up with a permanent staff of 92 and an annual budget appropriation for salaries of over $300,000.

During World War II, Mr. Mitchell was appointed by the mayor of

(*See* MITCHELL *on page 443*)

F. B. Crandall is one of the few native born Californians who have not elected to remain in the Golden State for life. Born in Pasadena, Mr. Crandall moved to Oregon in 1925. He attended the State College at Corvallis from 1925 to 1929, returning in 1936 to graduate in Civil Engineering. Mr. Crandall does not credit his success entirely to his formal education, contending that much invaluable training in public relations was obtained during summer vacations during his high school and college years when he followed the profession of an ice man.

His first position with the Oregon State Highway Department, for which he is now traffic engineer, was in 1929. He left the department in 1933 to become a member of the great army of the unemployed in California. Odd jobs with the city of Sedungo, Public Roads Administration, and the Standard Oil Company provided sufficient funds to return to Oregon State College for the six months necessary to obtain his degree.

Returning to the Highway Department in 1936, Mr. Crandall was assigned as division supervisor in the traffic engineering division, a position he held until 1942 when he became acting traffic engineer.

Married and the father of two chil-

(*See* CRANDALL *on page 443*)

(MITCHELL, *Cont. from page 442*)
Philadelphia and the civilian defense directors of four surrounding counties as transportation director of the Philadelphia-Metropolitan War Transportation Committee. He was also appointed by the Office of Defense Transportation to membership on the Truck Appeal Board for the rationing of trucks in four eastern states, served as Transportation Officer of the Civilian Defense Council, as Advisory Transportation Officer for the Third Service Command, and as Mileage Administrator for the local county and city governments and their employees.

Mr. Mitchell is active in the following organizations: Alpha Tau Omega fraternity; the Sphinx Head honor society; American Public Works Association; Municipal Division of the American Road Builders Association; Pennsylvania Society of Professional Engineers; Engineers' Club of Philadelphia; Chairman, Sub-committee on Traffic Signals, Joint Committee on Uniform Traffic Control Devices; and Chairman, Traffic and Transportation Committee, American Road Builders Association.

(CRANDALL, *Cont. from page 442*)
dren, Mr. Crandall limits his hobbies to activities necessary to the social life of his offspring. As an expert designer and builder of model airplanes, he is chief assistant to his seven-year old son, Bill. He is too young to play golf.

Mr. Crandall is a member of the ITE Board of Direction and serves as secretary to the Oregon State Speed Control Board. He is also secretary to the Northwestern Society of Highway Engineers, is active in the American Association of State Highway Officials, and is a member of the Committee for the Revision of the Manual on Uniform Traffic Control Devices.

ITE, IMSA COOPERATE

The Board of Direction recently approved a new plan of cooperative effort to be undertaken by the International Municipal Signal Association and the Institute. It is anticipated that a much-needed contribution in the field of traffic signal control will result from a joint study covering both the features of particular importance to the construction and operating men and also the functional requirements of the Traffic Engineer.

The joint activity will be undertaken by the Traffic Control Devices Committee of IMSA, Fred J. Meno II, of the Detroit Public Lighting Commission, Chairman, and the Sub-committee on Traffic Signals, Standards and Specifications Committee, ITE, Wayne N. Volk, Chairman. The latter committee is currently preparing specifications for traffic-actuated controllers.

William F. Qualls of New York City is president of International Municipal Signal Association, Inc.

HOLD OPEN HOUSE

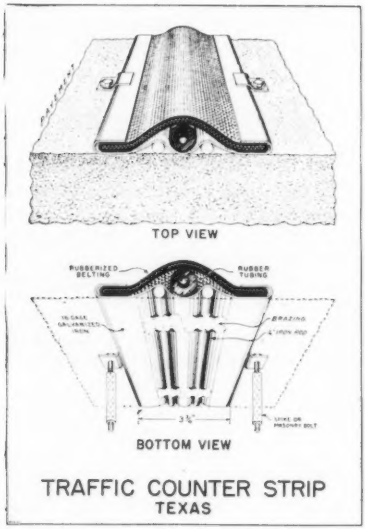
Thousands of traffic-safety conscious citizens of Wichita, Kansas, visited a traffic engineering display at Wichita's city hall during "Know Your City" week recently.

The special "open house" activities were in connection with the celebration of Wichita's thirtieth anniversary under the commission-manager form of city government.

Wichita, winner of six national and six state traffic safety awards since 1942, named the nation's safest city in 1945, is made up of 155,000 citizens who consider traffic safety to be the responsibility of every motorist.

George Fisher (Assoc.) is Wichita's traffic engineer.

REFERENCE NOTES



TRAFFIC COUNTER STRIP
TEXAS

Pictured here is a protective covering known as a "traffic counter strip" which was developed by the Texas Highway Department to prolong the life of rubber road tube used with traffic counters and to adapt the tube for use on gravel and dirt roads. It is also effective on paved city streets.

The base of the strip is formed from a sheet-metal plate approximately six inches wide. The length of the plate varies with the roadway width. Two ¼″ iron rods, brazed to the bottom of the strip, aid in forming a well for the tube. The sides and ends of the sheet-metal plate are crimped to clamp over a 4-inch web belt (3/16″ thickness) which covers and protects the tube.

The sheet-metal plates, as used in Texas and Louisiana, are fabricated in 10-foot lengths to facilitate handling. Normally, two 10-foot lengths are placed end to end and connected by a continuous 20-foot length of web belting. The strips are held to the roadway by side clamps.

The tube is connected to the traffic recorder through a conduit which runs underground from the recorder to a point beneath the sheet-metal plate and approximately four inches from one end. The far end of the rubber tube is plugged.

Pre-mix asphalt approaches are used to slope the strip to the pavement on city streets.

ESSEX FREEWAY PLANNERS NAMED

Planners for the Essex east-west freeway will be the firm of Edwards and Kelcey, consulting engineers, of Newark and New York, State Highway Commissioner Miller disclosed recently. The firm has been instructed to survey the complete east-west traffic problem in the Essex metropolitan district and submit a recommendation including detailed route and profile plans for such throughways as are needed to meet present and anticipated needs.

The partnership was formed last June between Dean G. Edwards, former chief highway and sewer engineer for the Borough of Manhattan, and Guy Kelcey, who directed the Port of New York Authority's analysis for the half-billion dollar postwar highway program for the metropolitan area.

A member of the citizens' committee for the relief of traffic congestion in New Jersey, Kelcey was in charge of traffic planning in Montclair in 1945 and from 1942 to 1944 was regional director for the Division of Local Transport of the Office of Defense Transportation in the South. Mr. Kelcey is a member of ITE.

PARK-N-LOT*

THE NEW 10-HOUR MODEL
PARK-O-METER

. . . will pay for *Municipally* owned off-street parking lots and solve your whole parking problem!

PARK-N-LOT* meters are *positively doing the job* in cities now using them. They will do the same for you. Ask us to put you in touch with city officials who will give you their experience.

PROFITABLE Park-N-Lot* Meters pay for themselves quickly . . . pay for off-street parking facilities then continue to bring in revenue year after year.

DURABLE These automatic meters employ the same time-proved mechanism that has made Park-O-Meter the outstanding parking meter throughout the nation. They are foolproof, simple to operate, require minimum attention and servicing.

UNIVERSAL Park-N-Lot* Meters can be set and reset to meet every parking requirement in both busy and fringe areas. Here is a typical operating plan:

FRINGE AREA	BUSY AREA
2 hours, 1 nickel	1 hour, 1 nickel
4 hours, 2 nickels	2 hours, 2 nickels
6 hours, 3 nickels	3 hours, 3 nickels
8 hours, 4 nickels	So on through 10 hours
10 hours, 5 nickels	5 hours, 1 quarter
10 hours, 1 quarter	10 hours, 2 quarters

* Registered Trade Mark U. S. Pat. Off.

DELIVERIES NOW BEING MADE

Magee-Hale **PARK-O-METER COMPANY**

COMMERCE EXCHANGE BUILDING • OKLAHOMA CITY 2, OKLAHOMA

MACNICK DIVISION, *Manufacturers*, TULSA, OKLAHOMA

OPEN DISCUSSION

Constructive is the key-word to describe Mr. Petterman's discussions of signal timing. (Traffic Engineering Magazine, February and March, 1947). He has stripped the technique of signal timing to its grass-root essentials and, in so doing, has rendered a distinct service to the scores of small cities throughout the United States which, by and large, do not have the facilities for elaborate studies nor the means to support a traffic engineering staff.

It is by no means suggested that Mr. Petterman's discussions are of interest only to those outside the field of professionals for observations in many of our large cities indicate that many traffic engineering staffs have become so involved in the nebulae of abstractions as to lose sight of realities.

The writer is not presuming to elaborate upon the Petterman discussions, but is merely pointing up certain aspects of the relationship between light cycles and traffic densities.

In the first place, the formula for the determination of the GO interval for one direction at an intersection is the essence of simplicity. It states simply that it will take the first vehicle about 4 seconds after the green appears to get into the intersection and that succeeding vehicles will enter at about a 2-second headway. I have checked these values at several intersections in Asheville and find close agreement. Based upon this formula the accompanying table has been constructed. It shows for specified traffic densities the number of vehicles which will accumulate under various cycle lengths and the required time to pass through the intersection. If a progressive system is being established, the table can be used as a reference guide to determine the shortest possible cycle that can be used in the presence of observed traffic densities. Of course, this applies to vehicular movement times and the indicated cycle length can be modified to meet the requirements of intersectional movements of pedestrians.

An analysis of Mr. Petterman's discussions points up the fact that the efficiency of cycle lengths decreases as the cycle length increases.

Mr. Petterman should be highly commended for his contributions and the Institute would be rendering a definite public service if it encouraged more of such writings.

CHARLES STEPHENSON,
White Transportation Co.
Asheville, N. C.

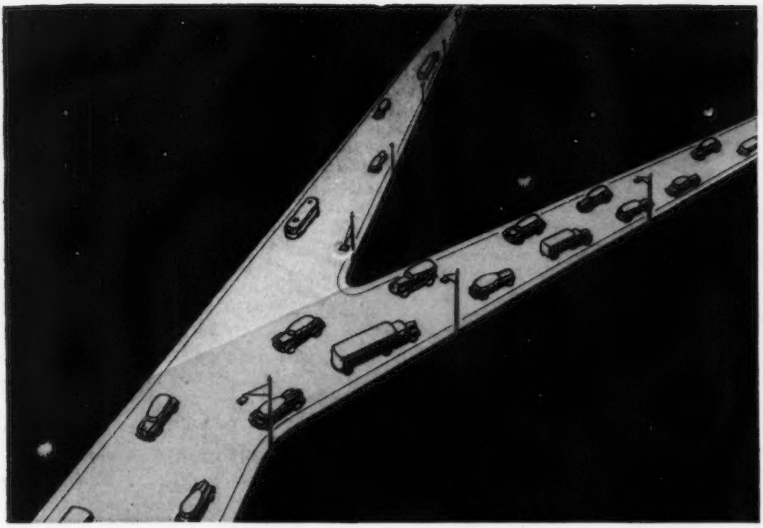
RELATION BETWEEN LIGHT CYCLES AND TRAFFIC DENSITY

Cycle Specifications			Traffic Density (Vehicles Per Lane Per Hour)					
			100		200		300	
Length Of Cycle	Phase Distribution	Cycles Per Hour	Vehicles Per Cycle	Time To Pass	Vehicles Per Cycle	Time To Pass	Vehicles Per Cycle	Time To Pass
30	15-15	120	0.83	4.0	1.67	4.3	2.50	7.0
40	20-20	90	1.10	4.2	2.20	6.4	3.30	8.6
50	25-25	72	1.39	4.8	2.78	7.6	4.17	10.3
60	30-30	60	1.67	5.3	3.34	8.7	5.01	12.0
70	35-35	51.4	1.95	5.9	3.90	9.8	5.85	13.7
80	40-40	45	2.22	6.4	4.44	10.9	6.66	15.3
90	45-45	40	2.50	7.0	5.00	12.0	7.50	17.0
100	50-50	36	2.78	7.6	5.56	13.1	8.34	18.7

RELATION BETWEEN LIGHT CYCLES AND TRAFFIC DENSITY

Cycle Specifications			Traffic Density (Vehicles Per Lane Per Hour)						
			400		500		600		Max No. of Veh. Ind. Cycles Will Pass Per Lane Per Hour
Length Of Cycle	Phase Distribution	Cycles Per Hour	Vehicles Per Cycle	Time To Pass	Vehicles Per Cycle	Time To Pass	Vehicles Per Cycle	Time To Pass	
30	15-15	120	3.33	8.7	4.17	10.3	5.00	12.0	780
40	20-20	90	4.40	10.8	5.50	13.0	6.60	15.2	810
50	25-25	72	5.56	13.1	6.95	15.9	8.34	18.7	828
60	30-30	60	6.68	15.4	8.35	18.7	10.02	22.0	840
70	35-35	51.4	7.80	17.6	9.75	21.5	11.70	25.4	848
80	40-40	45	8.88	19.8	11.10	24.2	13.32	28.6	855
90	45-45	40	10.00	22.0	12.50	27.0	15.00	32.0	860
100	50-50	36	11.12	24.2	13.90	29.8	16.68	35.4	864

Note: This table constructed under the most unfavorable conditions at an intersection; that is, with all cars stopped. It is assumed that it will take the first vehicle 4 seconds after green appears to move into the intersection and that succeeding vehicles will enter on a 2-second headway.



HOW SODIUM LIGHTING CAN HELP ROUTE TRAFFIC

Sodium lighting, recognized as the most efficient system of street and highway lighting, is assuming an additional significant job—the marking of through-traffic routes at night. Its distinctive color unmistakably directs traffic onto through streets, onto by-passes, or through complicated intersections.

Adequate lighting, whether with sodium, mercury or incandescent lamps, increases the safety and the after-dark capacity of traffic routes—important, because peak loads on such thoroughfares, particularly during winter months, occur after sundown.

More and more, traffic engineers are looking to light to help solve street and highway congestion and safety problems. General Electric lighting specialists have had broad experience in such planning—including sodium lighting of hazardous intersections and increasing capacity of express highways and thoroughfares. You can get in touch with these specialists through our nearest apparatus office, or by writing General Electric Company, Schenectady 5, N.Y.

GENERAL ELECTRIC

452-54

LETTERS TO THE EDITOR

The members of the 1947 Research Committee of the Institute of Traffic Engineers have approved the following phased program to serve as a general guide in procedure during the current year toward furthering the objectives of the Committee:

Recommended Committee activity by phases:

I. A comprehensive survey of organizations, agencies, the Institute membership, and other fruitful sources to accomplish a compilation of recommended projects or subjects bearing directly upon or related to traffic engineering, with particular attention to keeping the recommended subjects in rather narrow and specific fields of endeavor, rather than trying to interpret or develop the research needs of traffic engineering in terms that are too broad or too general to permit adaptation to research techniques.

II. A determination of the extent of the research activity that has been contemplated, initiated or is actually well under way on any or all of the previously compiled listing; and also the agency, organization, department or individual that is considering or is undertaking the project.

III. Based on the studied opinions of the Committee membership and coordinated where possible with other individuals and agencies active in the traffic engineering and highway engineering field, to determine and establish a priority listing of the projects upon which no research activity is currently progressing; the priority to be established on the basis of the anticipated need and usefulness in traffic engineering. Consideration should be given to the practical application of the results to be attained in the everyday solution of traffic engineering problems.

IV. Explore the possibilities for, and then develop, cooperative action between the Institute and other agencies that have the facilities and are in a position to carry out research activities to a conclusion on the projects that have been selected by the Committee and approved by the Institute. Selection and allocation of the projects would be, as much as posible, guided by the priority established in Phase III.

To date a subcommittee under the Chairmanship of Mr. O. K. Normann, Public Roads Administration, has been established to develop Phase I and subsequently Phase II of the program. Since the program is progressively phased, progress for this year is almost completely dependent upon the work of this subcommittee in rapidly developing a comprehensive list of recommended projects.

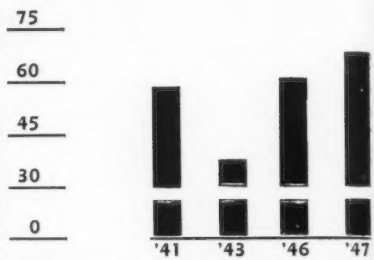
It is believed that at this time a major contribution can be made by the entire membership of the Institute in giving Mr. Normann's subcommittee, at the earliest possible date, a list of projects adaptable to research techniques that warrant the interest and attention of the profession.

Specific titles which definitely identify the needed research and limits the work to one certain phase are preferred to the more general titles. For example, it would be much better to qualify the project by using a title such as "the durability of reflectorized paint versus plain paint for pavement markings" or "the effectiveness of a dashed centerline as compared with a solid centerline" rather than the general title "pavement markings".

It is requested that the entire membership exercise every means at their disposal to review projects or information that they may have in their files, to contact highway engineers and engineers in related fields, and to forward their recommendations and/or suggestions for needed traffic engineering research projects to: Mr. O. K. Normann, Division of Highway Transport Research, Public Roads Administration, 3033 Federal Works Building, Washington 25, D. C., for consideration by the Phase I subcommittee.

LIGHT B. YOST, Chairman,
Research Committee, Institute of
Traffic Engineers.

TRAFFIC TRENDS



TRAVEL ON RURAL ROADS FOR FIRST FIVE MONTHS OF 1941, 1943, 1946 AND 1947.

[Based on Public Roads Administration Data]

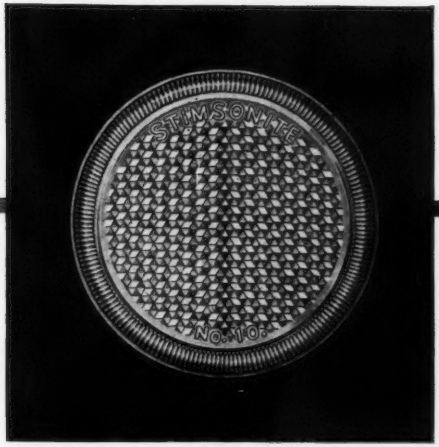
ACTUAL FIGURES (Billions)

1941	61.8
1943	37.4
1946	63.8
1947	69.7

SEEK TRAFFIC TUNNEL

Portland, Ore., civic organizations last week launched a campaign for construction of a multi-lane tunnel under the Willamette River, which flows from south to north through the city.

Traffic between the two sectors of the city is at present accommodated by eight bridges—two of them crossing a ship channel—and only one with sufficient clearance to obviate the use of drawbridges. Traffic jams on the bridges, mostly caused by frequent opening of the draw spans, are said to be responsible for numerous accidents, and cost millions annually in lost time. (*Eng. News-Record.*)



The NEW STIMSONITE Reflector

Another FIRST for Stimsonite Plastics!

Now, an all plastic, one-piece reflector formed by fusing a Lucite back piece with the well-known Stimsonite Reflector. No metal parts or gaskets.

The new Stimsonite Reflector being complete in itself is dust and moisture proof regardless of age, weather or service.

Immediately available in sizes for traffic and highway signs and markers, railroads, airports and as aids to navigation. Colors: clear, red, yellow and green.

Catalogue and complete information will be gladly sent on request.

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WESTPORT TRAFFIC PLAN IS PRESENTED

The first point of a recommended 51-point program for the improvement of traffic conditions and street safety in Westport became a reality recently when a 12-man traffic committee met to consider the recommended program. Formation of the committee was urged in a detailed report by traffic engineers of the National Conservation Bureau, accident prevention division of the Association of Casualty and Surety Companies, following a traffic survey of the city's streets. J. A. Carrothers (Assoc. Mem.) of the Bureau was in direct charge of field survey work.

"The Westport traffic survey came as a result of conditions there which are almost universal throughout the country," said Henry K. Evans, (Assoc. Mem.) director of the traffic engineering division of the National Conservation Bureau.

Most of the 51 recommendations made in the report deal with specific hazardous or inconvenient conditions in Westport. Several, however, could be applied in almost any city of like size in the country, Mr. Evans said. These "universal" recommendations include:

Appointment of an official traffic committee, increased man hours applied to traffic safety, one Police Department official responsible for traffic matters, adoption of vigorous traffic signal maintenance and replacement program, police should use standard accident report, wide publicity given all changes in traffic regulations and devices, driver education courses in the high schools, ordinance requiring all future developments to provide parking space, and cooperation with neighboring communities and in regional planning for uniform traffic procedure.

ANNUAL AAA PARADE

One of the highlights of the year in elementary school safety is the annual Washington, D. C. parade of school safety patrol members sponsored by the schools, police and automobile clubs affiliated with the American Automobile Association.

This year on May 10, after a rousing send-off by General of the Army Dwight D. Eisenhower, fifteen thousand boy and girl school safety patrol members from fourteen states and the District of Columbia marched down Constitution Avenue to the plaudits of upwards of 50,000 spectators. The parade was featured by safety slogan banners, drill teams, colorful costumes and ingenious floats carrying safety messages, seventeen school bands, and was led by the U. S. Navy Band.

The 15,000 marchers in the parade represent more than 300,000 school safety patrol members who, with their white Sam Browne belts and badges, give daily protection to schoolmates throughout the school year in some 6,000 communities.

ITE members of the AAA's Washington office include: Burton Marsh, Earl Allgaier, Le Verne Johnson, and W. L. Robinson.

SHREVEPORT SURVEY

A highway plan report for the City of Shreveport, La., has been prepared by H. W. Lochner and Co. of Chicago. Based on origin and destination data obtained by the Louisiana Department of Highways in cooperation with the Public Roads Administration, the report recommends a system of urban expressways designed to facilitate existing conditions and cope with an anticipated increase in population by 1967 of 66,000 people. The present population is estimated at 203,000. The report also deals with the parking problem and recommendations are made for zoning and building ordinances.

MICHIGAN STARTS STUDY

A state-wide study for a proposed program of highway improvement is under way in Michigan with Automotive Safety Foundation engineers acting in consulting capacity at the invitation of the Michigan Good Roads Federation. G. Donald Kennedy is directing ASF participation with Carl Fritts, highway engineer, doing most of the field work. Grant Mickle, ASF traffic engineer, also is assisting in the work. Kennedy, Fritts and Mickle are ITE members.

Three technical committees in Michigan are studying engineering standards for state, county and city needs. A state advisory committee, to include representatives of highway user groups, other interested groups and affected governmental agencies, is being formed.

(YALE, *Continued from page 435*)

Highway Dept. Jerome D. Franklin, Andrews & Clark, Consulting Engineers, New York City. H. Dean Fravel, U. S. Public Roads Administration, New Mexico. George A. Hill, Design Division, California Highway Dept. John H. Hulse, Design Division, New Jersey Highway Dept. A. L. Hutchison, Traffic and Safety Dept., California Highway Dept. Herbert J. Klar, W.V.N. Powelson, Consulting Engineer, New York City. E. C. M. Lee, Honolulu City Planning Commission, Hawaii. Emrys E. Lewarch, Traffic Engineering Div., City of Seattle, Washington. Captain Edwin L. Mills, Transportation Corps., U. S. Army. Robert E. Schmidt, Division of Highways, N. Y. State Dept. of Public Works. S. T. Siegel, U. S. Navy Civil Engineer Corps, Washington, D. C. Richard I. Strickland, Traffic Design Section, Michigan State Highway Dept. Arthur M. White, Maintenance Division, Mississippi State Highway Dept. James R. Wichman, Road Design Division, Michigan State Highway Dept. Murray Zides, Highway Division, New Brunswick Dept. of Public Works, Canada.

A majority of these graduates were members of the Yale student I.T.E. chapter and many are now members of the Institute.

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For Over 21 Years Manufacturers of

TRAFFIC, FIRE ALARM & RAILWAY EQUIPMENT

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(HARTFORD, *Cont. from page 424*)

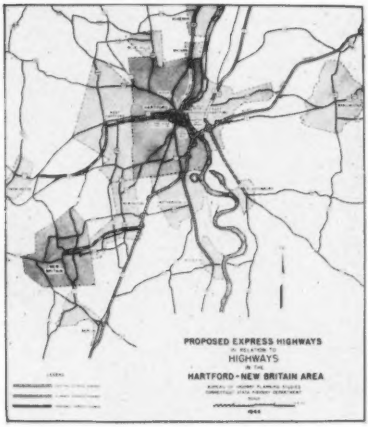

Figure 4

Berlin, through Newington, Wethersfield, and by the Hartford by-pass to the Charter Oak Bridge. The extension of the Wilbur Cross Parkway in the upper right-hand corner of the sketch is now under construction and will be completed within the near future. The dotted lines show the most recent development in expressway planning, but probably will not be constructed until a much later date.

It was very fortunate that it was possible to carry out the new bridge project at the time they did, since this project dovetailed perfectly with other improvements that were being made for flood protection in the Hartford area. These greatly increased the utility of the bridge, at very small additional cost. It made it possible for bridge traffic to reach points almost within a stone's throw of the State Capitol and of the City Hall without encountering any cross traffic and without being subject to any delays or traffic hazards. The flood protection work, which has been completed, was designed to provide for future expressway construction without further land acquisition costs. This will considerably assist in expediting the completion of more expressways in Hartford within the near future.

The author was formerly employed as Senior Assistant Engineer in the Department of Engineering, City of Hartford.

(Photographs and maps provided through courtesy of the Connecticut State Highway Department.)

ON THE SHELF

BIBLIOGRAPHY ON AUTOMOBILE PARKING IN THE UNITED STATES. Compiled in the Libraries of the Federal Works Agency. Public Roads Administration, 1946. 47 pp: processed.

Classified bibliography. General discussions and solutions.

TRAFFIC PATTERNS AND LATERAL PLACEMENT OF VEHICLES. Walter B. Wilson. Progress Report No. 1, Traffic Research, Purdue University, 1946. 18 pp. mimeo.

Study of intersections and lateral placement of vehicles by the use of a "lateral placement" machine which utilizes a series of rubber tubes stretched across the highway which intercept and trace vehicular paths with respect to the edge of the pavement.

PARKING STUDY OF THE PITTSBURGH CENTRAL BUSINESS DISTRICT, prepared by the Pittsburgh Regional Planning Association for the 'Allegheny Conference on Community development". 1945-1946.

This comprehensive study had two objectives: (1) To evolve a sound method for the solution of off-street parking problems (2) To apply this method specifically to the parking problem of the Pittsburgh Central Business District.

The report recommends the creation

THAT'S THE STREET SIGN FOR US MR. SUPERINTENDENT IT'S BEAUTIFUL BUT VERY PRACTICAL TOO !

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- 45 years of successful manufacturing of signs have made GROTE products nationally accepted for all traffic control problems.

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BELLEVUE, KY. · · · OPPOSITE CINCINNATI, OHIO

of a municipal parking authority; advantages are pointed out. Special legislation for the authority is recommended. Design standards for off-street parking parages and the total program of providing twenty new parking garages is estimated to require an expenditure of approximately $36,000,000.

PROCEEDINGS, THIRTEENTH ANNUAL CONFERENCE, American Association of Motor Vehicle Administrators. Chicago, November 13-16, 1945. 30 pp.

THE INTERSTATE HIGHWAY SYSTEM: Address of Senator Randolph Collier, Chairman of the California Legislature's Committee on Highways, Streets and Bridges, before a meeting of the California Commission on Interstate Cooperation, in San Francisco, November 20, 1946. 6 pp. mimeo.

STATE HIGHWAY ADMINISTRATION IN CALIFORNIA: Address of Senator Randolph Collier, Chairman of the Joint Fact-Finding Committee on Highways, Streets and Bridges, before the Annual Meeting of the California State Chamber of Commerce, in San Francisco on December 4, 1946. 13 pp. mimeo.

Discusses size, general location and cost of a modern system of highways for California; how such a system is to be paid for; which levels of government are best fitted to administer the various segments of the road plant; and how the use of the system shall be regulated.

THE NINETEENTH ANNUAL HIGHWAY CONFERENCE OF THE UNIVERSITY OF COLORADO. University of Colorado Engineering Experiment Station, 1946. Highway Series No. 19. 38 p.

CONNECTICUT'S ROAD PROGRAM. Connecticut State Highway Department. 1946. 55 pp. Report of present facilities and future needs for state highways, expressways and local roads and the methods of financing.

PROPOSED SYSTEM OF TRAFFICWAYS, a Master Plan Report, No. 4 of a series issued by the Detroit City Plan Commission, 1946. 24 pp.

APPLICATION OF STATISTICAL SAMPLING METHODS TO TRAFFIC PERFORMANCE AT URBAN INTERSECTIONS. Bruce D. Greenshields. Twenty-sixth Annual Meeting Highway Research Board, Washington, D. C., 1946. 24 pp.

"It is the purpose of this paper, after first showing that road traffic follows a "random" series to examine the nature of such a series, and then to demonstrate how the statistical principles involved may be applied in the solution of some typical traffic problems."

AN ANALYSIS OF GENERAL ENABLING LEGISLATION DEALING WITH AUTOMOBILE PARKING FACILITIES. Bulletin No. 2 (a tentative draft), reported by David R. Levin. Highway Research Board, Division of Engineering and Industrial Research, November, 1946. 88 pp. plus appendices.

Review of state enabling legislation and administrative authority. Discussion of inadequacy of present legislative provision for parking and of the essential elements of adequate laws. Appendices contain basic legislative data by states and models for state enabling legislation for automobile parking facilities.

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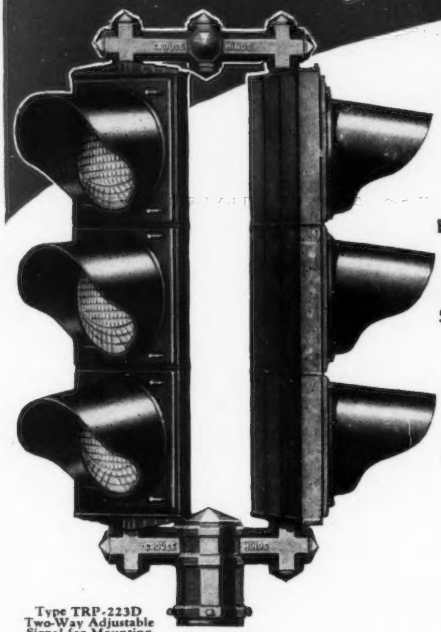

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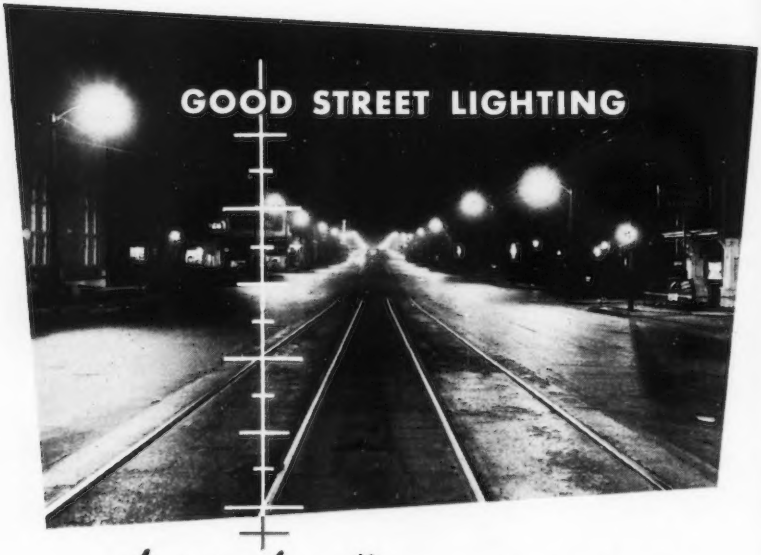

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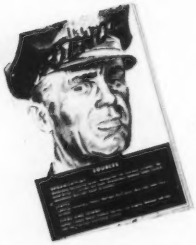

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HIGHWAY FINANCING FOR THE STATE OF CALIFORNIA, submitted to the Joint Fact-Finding Committee on Highways, Streets and Bridges of the California Legislature. Bertram Lindaman. California State Printing Office, 1946. 123 pp.

Leading features of the road and street problem; Economics of the future highway program; Comparison of cost and estimated revenue; Assignment of financial responsibility to highway beneficiaries; Fixing tax rates for the different classes of highway users; Budgeting of highway revenue; Financing road and street maintenance.

THE HIGHWAY CONSTRUCTION PROGRAM. Thomas H. MacDonald. 28th Annual Convention of the Associated General Contractors, Chicago, Illinois, January 27, 1947. 12 pp. mimeo.

PROCEEDINGS OF THE THIRTY-FIRST ANNUAL HIGHWAY CONFERENCE, held at Grand Rapids, Michigan, February 27, 28, 1946. Ann Arbor: The University. Official Publication vol. 48. No. 7, July 16, 1946.

ORIGIN — DESTINATION TRAFFIC SURVEY FOR MILWAUKEE METROPOLITAN AREA, 1946. Published by the State Highway Commission of Wisconsin, Madison, Wisconsin, as a study conducted jointly by the Highway Commission and Local Government Units in Cooperation with the U. S. Public Roads Administration, 1946. 75 pp.

PROCEEDINGS OF THE THIRD NEW ENGLAND TRAFFIC ENGINEERING CONFERENCE, June 11 to 13, 1946. Sponsored by Massachusetts Institute of Technology Civil Engineering Department and Massachusetts Department of Public Works, Traffic Engineering Section. New York: National Conservation Bureau, 1946. 63 pp.

SELECTED MEASURES FOR THE PARTIAL RELIEF OF TRAFFIC CONGESTION IN NEW YORK CITY. New York City Planning Commission, 1946. Major part of the report deals with parking provision for off-street facilities with maps, estimates of cost, etc.

PROCEEDINGS, SECOND OHIO TRAFFIC SAFETY CONFERENCE, June 13, 1946. Co-sponsored by Ohio Traffic Safety Council and Ohio Department of Highways.

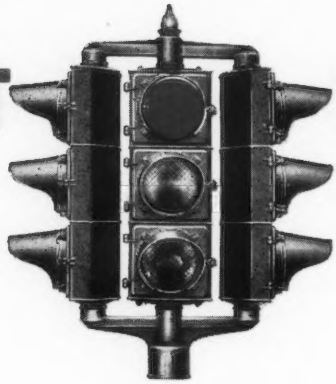
Reports on committee recommendations of the President's Highway Safety Conference and of Ohio's Action Program.

TRAFFIC SURVEY, REPORT AND RECOMMENDATIONS, PARKERSBURG, WEST VIRGINIA. Conducted by Traffic Engineering Division, National Conservation Bureau, 1946. 52 pp. mimeo.

OFF-STREET PARKING STUDY, by Gordon Whitnall for the Pomona, California City Planning Commission, 1946. 12 pp. 9 plates.

REPORT ON PARKING FOR THE ASSOCIATED RETAILERS OF SIOUX CITY, IOWA, by DeLeuw, Cather and Co., Chicago. 1946. 23 pp. 25 tables. mimeo.

Parking survey and study of layout and financing of parking facilities and of improvement of curb parking practices.

S T  P

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